WHAT IS CLAIMED IS:

Claim 1: A linear motor, comprising:

an armature; and

a needle with magnetism;

the armature being equipped at least with a magnetic pole of a first polarity having a first opposing section and another magnetic pole of a second polarity having a second opposing section; and

the needle being placed between the first opposing section and also between the second opposing section.

Claim 2: A linear motor according to Claim 1, wherein, when multiple armature units are installed and the magnetic pole pitch is assumed to be P, the magnetic pole tooth pitch between two adjacent armature units is (K•P+P/M) {(K=0, 1, 2, ...), (M=2, 3, 4, ...)} {K is an optional number not exceeding the maximum number of adjacent armature units to be installed, and M is the phase of the motor}.

Claim 3: A linear motor according to Claim 1, wherein, when multiple armature units are installed, of which two or more armature units form one phase, and the magnetic pole pitch is assumed to be P, the magnetic pole tooth pitch between two adjacent armature units of the same phase is (K•P) {K=0, 1, 2, ...} and the magnetic pole tooth pitch between two adjacent armature units of different phases is (K•P+P/M) {(K=0, 1, 2, ...), (M=2, 3, 4, ...)} {K is an optional number not exceeding the maximum number of adjacent armature units to be installed, and M is

the phase of the motor}.

Claim 4: A linear motor according to Claim 2, wherein, when multiple armature units are installed, of which two or more armature units form one phase, and the magnetic pole pitch is assumed to be P, the magnetic pole tooth pitch between two adjacent armature units of the same phase is (K•P) {K=0, 1, 2, ...} and the magnetic pole tooth pitch between two adjacent armature units of different phases is (K•P+P/M) {(K=0, 1, 2, ...), (M=2, 3, 4, ...)} {K is an optional number not exceeding the maximum number of adjacent armature units to be installed, and M is the phase of the motor}.

Claim 5: A linear motor according to Claim 1, wherein the magnetic pole tooth pitch of the armature units is either equal to or different from the magnetic pole pitch of the needle.

Claim 6: A linear motor according to Claim 2, wherein the magnetic pole tooth pitch of the armature units is either equal to or different from the magnetic pole pitch of the needle.

Claim 7: A linear motor according to Claim 3, wherein the magnetic pole tooth pitch of the armature units is either equal to or different from the magnetic pole pitch of the needle.

Claim 8: A linear motor according to Claim 4, wherein the

magnetic pole tooth pitch of the armature units is either equal to or different from the magnetic pole pitch of the needle.

Claim 9: A linear motor according to Claim 1, wherein there is provided a support mechanism for supporting the needle that moves relatively in the gap of the armature unit.

Claim 10: A linear motor according to Claim 2, wherein there is provided a support mechanism for supporting the needle that moves relatively in the gap of the armature unit.

Claim 11: A linear motor according to Claim 3, wherein there is provided a support mechanism for supporting the needle that moves relatively in the gap of the armature unit.

Claim 12: A linear motor according to Claim 4, wherein there is provided a support mechanism for supporting the needle that moves relatively in the gap of the armature unit.

Claim 13: A linear motor, comprising:

an armature; and

a needle having magnetic poles;

wherein the relative position of the needle perpendicular to the moving direction is maintained by an interaction between the armature and the needle.

Claim 14: A linear motor according to Claim 13, wherein, when multiple armature units are installed and the magnetic pole pitch is assumed to be P, the magnetic pole tooth pitch between two adjacent armature units is (K•P+P/M) {(K=0, 1, 2, ...), (M=2, 3, 4, ...)} {K is an optional number not exceeding the maximum number of adjacent armature units to be installed, and M is the phase of the motor}.

Claim 15: A linear motor according to Claim 13, wherein, when multiple armature units are installed, of which two or more armature units form one phase, and the magnetic pole pitch is assumed to be P, the magnetic pole tooth pitch between two adjacent armature units of the same phase is (K•P) {K=0, 1, 2, ...} and the magnetic pole tooth pitch between two adjacent armature units of different phases is (K•P+P/M) {(K=0, 1, 2, ...), (M=2, 3, 4, ...)} {K is an optional number not exceeding the maximum number of adjacent armature units to be installed, and M is the phase of the motor}.

Claim 16: A linear motor according to Claim 13, wherein the magnetic pole tooth pitch of the armature units is either equal to or different from the magnetic pole pitch of the needle.

Claim 17: A linear motor according to Claim 13, wherein there is provided a support mechanism for supporting the needle that moves relatively in the gap of the armature unit.

Claim 18: A manufacturing method of a linear motor comprising:

providing an armature and a needle having magnetic poles, wherein an armature core to be wound with a coil, magnetic poles on both sides; and

providing a magnetic pole unit integrated from upper magnetic pole teeth and opposed lower magnetic pole teeth obtained separately from laminated steel plate to form an armature unit;

wherein the armature equipped with a magnetic pole of the first polarity having the first opposing section and another magnetic pole of the second polarity having the second opposing section is provided by assembling the armature unit.

Claim 19: A manufacturing method of a linear motor comprising an armature made of magnetic material, a coil wound on the armature, and a needle that moves relatively to the armature by acting upon the magnetic field generated by the armature, comprising:

rows of magnetic pole teeth on one side which are magnetically connected to one magnetic pole of the armature and arranged at two stages, first and second, nearly perpendicular to the moving direction of the needle; and

rows of magnetic pole teeth on the other side which are magnetically connected to the other magnetic pole of the armature and arranged at two stages, first and second, nearly perpendicular to the moving direction of the needle;

wherein a first-stage tooth of the magnetic pole teeth on one side and a first-stage tooth of the magnetic pole teeth on the other side are arranged alternately along the moving direction of the needle;

a second-stage tooth of the magnetic pole teeth on one side and a second-stage tooth of the magnetic pole teeth on the other side are arranged alternately along the moving direction of the needle; and

the needle is put between the first-stage magnetic pole teeth of both sides and the second-stage magnetic pole teeth of both sides;

wherein an armature unit integrated from the armature core, magnetic poles, and magnetic pole teeth in one piece is manufactured separately from laminated steel plate and the armature is constructed by combining the separately manufactured armature unit and the coil.